[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Proposed Revisions to Advisory Circular--Flight Test Guide for Certification of Transport Category Airplanes.

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of proposed advisory circular and request for comments.

SUMMARY: This notice announces the availability of and requests comments regarding proposed revisions to Advisory Circular (AC) 25-7, "Flight Test Guide for Certification of Transport Category Airplanes." AC 25-7 provides guidance on acceptable means, but not the only means, of demonstrating compliance with the airworthiness standards for transport category airplanes. The proposed revisions complement revisions to the airworthiness standards that are being proposed by a separate notice. This notice provides interested persons an opportunity to comment on the proposed revisions to the AC.

DATES: Comments must be received on or before [insert date 90 days from date of publication].

ADDRESSES: Send all comments on the proposed AC revisions to the Federal Aviation Administration, Attention: Don Stimson, Flight Test and Systems Branch, ANM-111, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Ave SW., Renton, Wa 98055-4056. Comments may be examined at the above address between 7:30 a.m. and 4:00 p.m. weekdays, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Patricia Siegrist, Regulations Branch, ANM-114, at the above address, telephone (206) 227-2126.

SUPPLEMENTARY INFORMATION:

Comments Invited

A copy of the subject AC may be obtained by contacting the person named above under "FOR FURTHER INFORMATION CONTACT." Interested persons are invited to comment on the proposed revisions to the AC by submitting such written data, views, or arguments as they may desire. Commenters must identify the title of the AC and submit comments in duplicate to the address specified above. All comments received on or before the closing date for comments will be considered by the Transport Standards Staff before issuing the final revised AC.

Discussion

On May 22, 1990, the Aerospace Industries Association of America, Inc. (AIA) and the Association Europeenne des Constructeurs de Material Aerospatial (AECMA) jointly petitioned the FAA and the European Joint Aviation Authorities (JAA) to harmonize certain airworthiness requirements that apply to transport category airplanes. In their petition, published in the July 17, 1990 edition of the Federal Register (55 FR 137), AIA and AECMA also recommended changes to Advisory Circular (AC) 25-7, "Flight Test Guide for Certification of Transport Category Airplanes," to ensure that the harmonized standards would be interpreted and applied consistently.

Part 25 of the Federal Aviation Regulations (FAR) prescribes the United States airworthiness standards for transport category airplanes. Advisory Circular (AC) 25-7 provides guidelines that the FAA has found

acceptable for flight testing transport category airplanes to demonstrate compliance with those airworthiness standards. Revisions to part 25, in response to the AIA/AECMA petition, are being proposed by the FAA in a notice of proposed rulemaking published elsewhere in this issue of the Federal Register. That notice also describes the use of the Aviation Rulemaking Advisory Committee (ARAC) to develop both the proposed revisions to Part 25 and the proposed revisions to AC 25-7.

The proposed revisions to AC 25-7 provide additional guidance material and one means, but not the only means, of complying with the part 25 revisions proposed in Notice No. 93-[insert notice number of NPRM entitled, "Revision of Certain Flight Airworthiness Standards to Harmonize with European Airworthiness Standards for Transport Category Airplanes," to be published in the same edition of the Federal Register]. Issuance of the revised AC is contingent on final adoption of the proposed revisions to part 25.

Issued in Renton, Washington, on

DRAFT WORKING MATERIAL
NOT FOR PUBLIC RELEASE 8/27/93

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

[14 CFR Parts 1 and 25]

[Docket No. 26250; Notice No.]

RIN:

Revision of Certain Flight Airworthiness Standards to Harmonize with European Airworthiness Standards for Transport Category Airplanes.

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of proposed rulemaking.

SUMMARY: The Federal Aviation Administration proposes to amend part 25 of the Federal Aviation Regulations (FAR) to harmonize certain flight requirements with standards contained in the European Joint Aviation Requirements (JAR)-25. These proposals are in response to a petition from the Aerospace Industries Association of America, Inc. and the Association Europeenne des Constructeurs de Material Aerospatial. These changes are intended to benefit the public interest by standardizing certain requirements, concepts, and procedures contained in the airworthiness standards of the FAR and the JAR.

DATES: Comments must be received on or before [insert date 90 days from date of publication].

ADDRESSES: Comments on this notice may be mailed in duplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket (AGC-10), Docket No. 26250, 800 Independence Avenue S.W., Washington, D.C. 20591; or delivered in duplicate to: Room 915G, 800

Independence Avenue S.W., Washington, D.C. 20591. Comments delivered must be marked Docket No. 26250. Comments may be examined in Room 915G weekdays, except Federal holidays, between 8:30 a.m. and 5:00 p.m. In addition, the FAA is maintaining an information docket of comments in the Office of the Assistant Chief Counsel (ANM-7), Federal Aviation Administration, Northwest Mountain Region, 1601 Lind Avenue S.W., Renton, Washington 98055-4056. Comments in the information docket may be examined in the Office of the Regional Counsel weekdays, except Federal holidays, between 7:30 a.m. and 4:00 p.m.

FOR FURTHER INFORMATION CONTACT: Donald K. Stimson, Flight Test and Systems Branch, ANM-111, Transport Airplane Directorate, Aircraft Certification Service, FAA, 1601 Lind Avenue S.W., Renton, Washington 98055-4056; telephone (206) 227-1129; facsimile (206) 227-1320.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in this proposed rulemaking by submitting such written data, views, or arguments as they may desire. Comments relating to any environmental, energy, or economic impact that might result from adopting the proposals contained in this notice are invited. Substantive comments should be accompanied by cost estimates. Commenters should identify the regulatory docket or notice number and submit comments in duplicate to the Rules Docket address above. All comments received on or before the closing date for comments will be considered by the Administrator before taking action on this proposed rulemaking. The proposals contained in this notice may be changed in light of comments received. All comments received will be

available in the Rules Docket, both before and after the comment period closing date, for examination by interested persons. A report summarizing each substantive public contact with FAA personnel concerning this rulemaking will be filed in the docket. Persons wishing the FAA to acknowledge receipt of their comments must submit with those comments a self-addressed, stamped postcard on which is stated: "Comments to Docket No. 26250." The postcard will be date stamped and returned to the commenter.

Availability of the NPRM

Any person may obtain a copy of this notice by submitting a request to the Federal Aviation Administration (FAA), Office of Public Affairs, Attention: Public Information Center, APA-430, 800 Independence Avenue S.W., Washington, D.C. 20591; or by calling (202) 267-3484. The notice number of this NPRM must be identified in all communications. Persons interested in being placed on a mailing list for future rulemaking documents should also request a copy of Advisory Circular No. 11-2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedure.

Background

Part 25 of the Federal Aviation Regulations (FAR) contains the airworthiness standards for transport category airplanes. Manufacturers of transport category airplanes must show that each airplane they produce of a different type design complies with the relevant standards of part 25. These standards apply to airplanes manufactured within the U.S. for use by U.S.-registered operators and to airplanes manufactured

in other countries and imported under a bilateral airworthiness agreement.

In Europe, the Joint Aviation Requirements (JAR) were developed by the Joint Aviation Authorities (JAA) to provide a common set of airworthiness standards for use within the European aviation community. The airworthiness standards for European type certification of transport category airplanes, JAR-25, is based on part 25 of the FAR. Airplanes certificated to the JAR-25 standards, including airplanes manufactured in the U.S. for export to Europe, receive a type certificate that is accepted by the aircraft certification authorities of 19 European countries.

Although part 25 and JAR-25 are very similar, they are not identical. Differences between the FAR and the JAR can result in substantial additional costs when airplanes are type certificated to both standards. These additional costs, however, do not always bring about an increase in safety. For example, part 25 and JAR-25 may use different means to accomplish the same safety intent. In this case, the manufacturer is usually burdened with meeting both requirements, although the level of safety is not increased correspondingly. Recognizing that a common set of standards would not only economically benefit the aviation industry, but would also maintain the necessary high level of safety, the FAA and JAA consider harmonization to be a high priority.

On May 22, 1990, the Aerospace Industries Association of America, Inc. (AIA) and the Association Europeenne des Constructeurs de Material Aerospatial (AECMA) jointly petitioned the FAA and JAA to harmonize

certain requirements contained in FAR part 25 and JAR-25. In their petition, published in the July 17, 1990 edition of the Federal Register (55 FR 137), AIA and AECMA requested changes to §§ 25.143(c), 25.143(f), 25.149, and 25.201 to standardize the requirements, concepts, and procedures for certification flight testing and to enhance reciprocity between the FAA and JAA. In addition, AIA and AECMA recommended changes to FAA Advisory Circular (AC) 25-7, "Flight Test Guide for Certification of Transport Category Airplanes," to ensure that the harmonized standards would be interpreted and applied consistently. A copy of that petition is included in the docket for this rulemaking.

On September 26, 1991 the Aviation Rulemaking Advisory Committee (ARAC) established the Flight Test Working Group, assigning it the task of developing either a draft notice of proposed rulemaking (NPRM) or a denial of the AIA/AECMA petition. If accepted by the ARAC, the draft NPRM or petition denial would be delivered to the FAA as an advisory committee recommendation.

The public notice establishing the Flight Test Working Group appeared in the Federal Register on January 13, 1992 (57 FR 1297). The Flight Test Working Group was later renamed the Flight Test Harmonization Working Group and its scope was expanded to include developing a similar proposal to amend JAR-25, as necessary, to achieve harmonization.

The rulemaking proposal contained in this notice was developed by the Flight Test Harmonization Working Group. It was presented to the FAA by the ARAC as a recommended response to the AIA/AECMA petition. Rather than proposing a simple acceptance or denial of the petition, the

working group chose to use the petition as a starting point for developing a rulemaking proposal that would accomplish the goal of harmonizing not only the sections of FAR part 25 and JAR-25 addressed in the petition, but also related sections.

The Aviation Rulemaking Advisory Committee

The ARAC was formally established by the FAA on January 22, 1991 (56 FR 2190) to provide advice and recommendations concerning the full range of the FAA's safety-related rulemaking activity. This advice was sought to develop better rules in less overall time using fewer FAA resources than are currently needed. The committee provides the opportunity for the FAA to obtain firsthand information and insight from interested parties regarding proposed new rules or revisions of existing rules.

There are 56 member organizations on the committee, representing a wide range of interests within the aviation community. Meetings of the committee are open to the public, except as authorized by section 10(d) of the Federal Advisory Committee Act.

The ARAC establishes working groups to develop proposals to recommend to the FAA for resolving specific issues. Tasks assigned to working groups are published in the Federal Register. Although working group meetings are not generally open to the public, all interested parties are invited to participate as working group members. Working groups report directly to the ARAC, and the ARAC must concur with a working group proposal before that proposal can be presented to the FAA as an advisory committee recommendation.

The activities of the ARAC will not, however, circumvent the public rulemaking procedures. After an ARAC recommendation is received and found acceptable by the FAA, the agency proceeds with the normal public rulemaking procedures. Any ARAC participation in a rulemaking package will be fully disclosed in the public docket.

Discussion of the Proposals

The FAA proposes amending certain sections of the FAR, as recommended by the ARAC, to harmonize these sections with JAR-25. The JAA intend to publish a Notice of Proposed Amendment (NPA), also developed by the Flight Test Harmonization Working Group, to revise JAR-25 as necessary to ensure harmonization in those areas for which the proposed amendments differ from the current JAR-25. When it is published, the NPA will be placed in the docket for this rulemaking.

The FAA proposes to: (1) introduce the term "go-around power or thrust setting" to clarify certain part 25 flight requirements; (2) revise the maximum control forces permitted for demonstrating compliance with the controllability and maneuverability requirements; (3) provide requirements for stick force and stick force gradient in maneuvering flight; (4) revise and clarify the requirements defining minimum control speed during approach and landing; (5) clarify the procedural and airplane configuration requirements for demonstrating stalls and revise the list of acceptable flight characteristics used to define the occurrence of stall; and (6) require that stall characteristics be demonstrated for turning flight stalls at deceleration rates up to 3 knots per second.

Revisions are also proposed for AC 25-7 to ensure consistent application of these proposed revised standards. Public comments concerning the revisions to AC 25-7 are invited by separate notice published elsewhere in this issue of the Federal Register.

Proposal 1. Certain part 25 flight requirements involving flight conditions other than takeoff (i.e., §§ 25.119, 25.121(d), 25.145(b)(3), 25.145(b)(4), 25.145(b)(5), 25.145(c)(1), 25.149(f)(6), and 25.149(g)(7)(ii)), specify using the maximum available takeoff power or thrust as being representative of the appropriate maximum in-flight power or thrust. In practice, however, the power or thrust setting used to obtain the maximum in-flight power or thrust (commonly referred to as the go-around power or thrust setting) usually differs from the setting used for takeoff. In the past, the FAA interpreted the words "maximum available takeoff power or thrust" to mean the maximum in-flight power or thrust, with the takeoff power or thrust setting not always being "available" in flight. The FAA proposes changing the nomenclature to "go-around power or thrust setting" for clarity and to reflect terminology commonly used in the operational environment. (In the context of this discussion, the term "go-around" refers to a deliberate maneuver to abort a landing attempt prior to touchdown by applying the maximum available power or thrust, retracting flaps, and climbing to a safe level-off altitude.)

The go-around power or thrust setting may differ from the takeoff power or thrust setting, for example, due to the airspeed difference between the takeoff and go-around flight conditions. In addition, complying with the powerplant limitations of § 25.1521 may result in a

lower power setting at the higher airspeeds associated with a go-around. As another example, the controllability requirements of §§ 25.145(b)(3), 25.145(b)(4), 25.145(b)(5), 25.149(f), and 25.149(g) may also limit the go-around power or thrust setting to less than that used for takeoff. Another reason to separate the takeoff and go-around power (or thrust) nomenclature is that certification practice has not required, and applicants have not always proposed, changing the go-around power or thrust setting when a previously approved takeoff power or thrust is increased.

The FAA proposes to substitute the term "go-around power or thrust setting" for "maximum available takeoff power or thrust" in §§ 25.119, 25.121(d), 25.145(b)(3), 25.145(b)(4), 25.145(c)(1), 25.149(f)(6), and 25.149(g)(7)(ii). (Note that the requirement of § 25.145(b)(5) also uses the power specified in § 25.145(b)(4).) In addition, the FAA proposes to define "go-around power or thrust setting" in part 1 as "the maximum allowable in-flight power or thrust setting identified in the performance data." With this revision, the FAA intends to clarify that the applicable controllability requirements should be based on the same power or thrust setting used to determine the approach and landing climb performance contained in the approved Airplane Flight Manual (AFM).

The proposed terminology refers to a power or thrust "setting" rather than a power or thrust to make it clear that existing engine ratings are unaffected. The powerplant limitations of § 25.1521 would continue to apply at the go-around power (or thrust) setting. Existing certification practices also remain the same, including the relationship between the power or thrust values used to comply with the landing and

approach climb requirements of §§ 25.119 and 25.121(d). For example, the thrust value used to comply with § 25.121(d) may be greater than that used for § 25.119, if the operating engine(s) do not reach the maximum allowable in-flight thrust by the end of the eight second time period specified in § 25.119.

Proposal 2. The FAA proposes to revise the table in § 25.143(c) to match the control force limits currently provided in JAR 25.143(c). This table prescribes the maximum control forces for the controllability and maneuverability flight testing required by §§ 25.143(a) and 25.143(b). For transient application of the pitch and roll control, the revised table would contain more restrictive maximum control force limits for those maneuvers in which the pilot might be using one hand to operate other controls, relative to those maneuvers in which both hands are normally available for applying pitch and roll control. The revised table would retain the current control force limits for transient application of the yaw control, and for sustained application of the pitch, roll, and yaw controls.

If, for the particular maneuver, only one hand is assumed to be available for applying pitch and roll control, the FAA proposes to reduce the maximum permissible control forces from 75 pounds to 50 pounds for pitch control, and from 60 pounds to 25 pounds for roll control. These lower control forces would be more consistent with § 25.145(b), which states that a force of 50 pounds for longitudinal (pitch) control is "representative of the maximum temporary force that readily can be applied by one hand." In addition to adding more restrictive control force limits for maneuvers in which only one hand

may be available to apply pitch and roll control, the FAA proposes to reduce the maximum permissible force for roll control from 60 pounds to 50 pounds for maneuvers in which the pilot normally has both hands available to operate the control.

The FAA proposes to further revise Section 25.143(c) by specifying that the table of maximum permissible control forces applies only to conventional wheel type controls. This restriction, also specified in the current JAR 25.143(c), recognizes that different control force limits may be necessary when considering sidestick controllers or other types of control systems.

For clarification , the FAA proposes to replace the terms "temporary" and "prolonged," used in §§ 25.143(c), 25.143(d), 25.143(e), and 25.145(b), with "transient" and "sustained," respectively. "Transient" forces refer to those control forces resulting from maintaining the intended flight path during changes to the airplane configuration, normal transitions from one flight condition to another, or regaining control after a failure. The pilot is assumed to take immediate action to reduce or eliminate these forces by re-trimming or by changing the airplane configuration or flight condition. "Sustained forces," on the other hand, refer to those control forces resulting from normal or failure conditions that cannot readily be trimmed out or eliminated. The FAA is proposing to add these definitions of "transient" and "sustained" forces to AC 25-7.

In addition, the FAA proposes several minor editorial changes for §§ 25.143(c) through 25.143(e) to improve readability and correct grammatical errors. For example, the words "immediately preceding" are

proposed to replace "next preceding" in § 25.143(d). These editorial changes are intended to clarify the existing interpretation of the affected sections.

Proposal 3. The FAA proposes to add the JAR 25.143(f) requirements regarding control force characteristics during maneuvering flight to part 25 as a new § 25.143(f). By adding these requirements, the FAA intends to ensure that the force to move the control column, or "stick," must not be so great as to make excessive demands on the pilot's strength when maneuvering the airplane, and must not be so low that the airplane can easily be overstressed inadvertently.

These harmonized requirements would apply up to the speed V_{FC}/M_{FC} (the maximum speed for stability characteristics) rather than the speed V_{MO}/M_{MO} (the maximum operating limit speed) specified by the current JAR 25.143(f). Requiring these maneuvering requirements to be met up to V_{FC}/M_{FC} is consistent with other part 25 stability requirements. Section 25.253, which defines V_{FC}/M_{FC}, would then be revised to reference the use of this speed in the proposed § 25.143(f). An acceptable means of compliance with § 25.143(f), including detailed interpretations of the stick force characteristics that meet these requirements, would be added to AC 25-7.

Proposal 4. Section 25.149(f) requires that the minimum control speed be determined assuming the critical engine suddenly fails during (or just prior to) a go-around from an all-engines-operating approach. For airplanes with three or more engines, § 25.149(g) requires the minimum control speed to be determined for a one-engine-inoperative landing approach in which a second critical engine suddenly fails. The

FAA proposes to revise §§ 25.149(f) through 25.149(h) to clarify and revise the criteria for establishing these minimum control speeds, V_{MCL} and V_{MCL-2}, respectively, for use during approach and landing.

The FAA proposes to clarify that V_{MCL} and V_{MCL-2} apply not only to the airplane's approach configuration(s), as prescribed in the current standards, but also to the landing configuration(s). The FAA recognizes that configuration changes occur during approach and landing (e.g., flap setting and landing gear position) and considers that the minimum control speeds provided in the AFM should ensure airplane controllability, following a sudden engine failure, throughout the approach and landing.

Applicants would have the option of determining V_{MCL} and V_{MCL-2} either for the most critical of the approach and landing configurations (i.e., the configuration resulting in the highest minimum control speed), or for each configuration used for approach or for landing. By determining the minimum control speeds in the most critical configuration, applicants would not be required to conduct any additional testing to that already required by the current standards. Only if these resulting speeds proved too constraining for other configurations would the FAA expect applicants to exercise the option of testing multiple configurations.

The FAA also proposes to add provisions to state the position of the propeller, for propeller airplanes, when establishing these minimum control speeds. For the critical engine that is suddenly made inoperative, the propeller position must reflect the most critical mode of powerplant failure with respect to controllability, as required by

§ 25.149(a). Also, since credit cannot be given for pilot action to feather the propeller during this high flightcrew workload phase of flight, the FAA proposes that V_{MCL} and V_{MCL-2} be determined with the propeller position of the most critical engine in the position it automatically achieves. For V_{MCL-2}, the engine that is already inoperative before beginning the approach may be feathered, since the pilot is expected to ensure the propeller is feathered before initiating the approach.

To assure that airplanes have adequate lateral control capability at V_{MCL} and V_{MCL-2}, the FAA proposes to require the airplane to be capable of rolling, from an initial condition of steady straight flight, through an angle of 20 degrees in not more than 5 seconds, in the direction necessary to start a turn away from the inoperative engine. This proposed addition to § 25.149 is contained in the current JAR 25.149.

The FAA is proposing guidance material for AC 25-7 to permit the applicant to additionally determine the appropriate minimum control speeds for an approach and landing in which one engine, and, for airplanes with three or more engines, two engines, are already inoperative prior to beginning the approach. These speeds, $V_{MCL(1\ out)}$, and $V_{MCL-2(2\ out)}$, would be less restrictive than V_{MCL} and V_{MCL-2} because the pilot is assumed to have trimmed the airplane for the approach with an inoperative engine (for $V_{MCL(1\ out)}$) or two inoperative engines (for $V_{MCL-2(2\ out)}$). Also, the approach and landing procedures under these circumstances may use different approach and landing flaps than for the situations defining V_{MCL} or V_{MCL-2}. These additional speeds can be used as guidance in determining the recommended procedures and speeds for a

one-engine-inoperative, or, in the case of an airplane with three or more engines, a two-engine-inoperative approach and landing.

The FAA proposes to revise § 25.125 to require the approach speed used for determining the landing distance to be equal to or greater than V_{MCL}, the minimum control speed for approach and landing with all-engines-operating. This provision would ensure that the speeds used for normal landing approaches with all-engines-operating would provide satisfactory controllability in the event of a sudden engine failure during, or just prior to, a go-around.

Proposal 5. The FAA proposes to revise the stall demonstration requirements of § 25.201 to clarify the airplane configurations and procedures used in flight tests to demonstrate stall speeds and stall handling characteristics. The list of acceptable flight characteristics used to define the occurrence of stall would also be revised. To be consistent with current practice, § 25.201(b)(1) would require that stall demonstrations also be conducted with deceleration devices (e.g., speed brakes) deployed. Additionally, the FAA proposes clarifying the intent of § 25.201(b) to cover normal, rather than failure, conditions by requiring that stalls need only be demonstrated for the "approved" configurations.

Section 25.201(c) would be revised to more accurately describe the procedures used for demonstrating stall handling characteristics. The cross-reference to § 25.103(b), currently contained in § 25.201(c)(1), would be moved to a new § 25.201(b)(4) for editorial clarity and harmony with the JAR-25 format. Reference to the pitch control reaching the aft

stop, which would be interpreted as one of the indications that the airplane has stalled, would be moved from § 25.201(c)(1) to § 25.201(d)(3).

The list of acceptable flight characteristics that define the occurrence of a stall, used during the flight tests demonstrating compliance with the stall requirements, is provided in § 25.201(d). The FAA proposes to revise this list to conform with current practices. Section 25.201(d)(1)(ii) would be removed to clarify that a rolling motion, occurring by itself, is not considered an acceptable flight characteristic for defining the occurrence of a stall. The proposed § 25.201(d)(2) would replace the criteria of § 25.201(d)(1)(iii) and 25.201(d)(2) because only deterrent buffeting (i.e., a distinctive shaking of the airplane that is a strong and effective deterrent to further speed reduction) is considered to comply with those criteria. Finally, if the airplane does not continue to pitch up after the pitch control has been pulled back as far as it will go and held there for a short period of time, the proposed § 25.201(d)(3) would define this condition as a stall. Guidance material would be added to AC 25-7 to define the length of time that the control stick must be held in this full aft position when using § 25.201(d)(3) to define a stall.

Proposal 6. Section 25.201 currently requires stalls to be demonstrated at airspeed deceleration rates (i.e., entry rates) not exceeding one knot per second. JAR 25.201 currently requires, in addition, that turning flight stalls must also be demonstrated at accelerated rates of entry into the stall (i.e., dynamic stalls). According to the JAA, the intended procedure for demonstrating dynamic stalls begins with a 1 knot

per second deceleration from the trim speed (similar to normal stalls). Then, approximately halfway between the trim speed and the stall warning speed, the flight test pilot applies the elevator control to achieve an increase in the rate of change of angle-of-attack. The final angle-of-attack rate and the control input to achieve it should be appropriate to the type of airplane and its particular control characteristics.

The AIA/AECMA petition detailed various difficulties with interpretation of the JAR-25 requirement, noted that the requirement is not contained in the FAR, and proposed that dynamic stalls be removed from JAR-25. Some of the concerns with the JAR-25 dynamic stall requirement include: (1) a significant number of flight test demonstrations for compliance used piloting techniques inconsistent with the capabilities of transport category airplanes; (2) the stated test procedures depend, to a large extent, on pilot interpretation, resulting in test demonstrations that could vary significantly for different test pilots; (3) the safety objective of the requirement is not well understood within the aviation community; and (4) the flight test procedures that are provided are inconsistent with the flight characteristics being evaluated. As a result, applicants are unable to ensure that their designs will comply with the JAR-25 dynamic stall requirement prior to the certification flight test.

In practice, FAA certification testing has typically included stall demonstrations at entry rates higher than 1 knot per second. For airplanes with certain special features, such as systems designed to prevent a stall or that are needed to provide an acceptable stall indication, higher entry rates are demonstrated to show that the system

will continue to safely perform its intended function under such conditions. These higher entry rate stalls are different, however, from the JAR-25 dynamic stalls.

Rather than simply deleting the dynamic stall requirement from JAR-25, or adding this requirement to part 25 of the FAR, the ARAC recommended harmonizing the two standards by requiring turning flight stalls be demonstrated at steady airspeed deceleration rates up to 3 knots per second. The FAA agrees with this recommendation and proposes to add the requirement for a higher entry rate stall demonstration to part 25 as § 25.201(c)(2). The current § 25.201(c)(2) would be redesignated § 25.201(c)(3). The JAA is proposing to replace the JAR-25 dynamic stall requirement with the ARAC recommendation.

The proposed higher entry rate stall demonstration is a controlled and repeatable maneuver that meets the objective of evaluating stall characteristics over a range of entry conditions that might reasonably be encountered by transport category airplanes in operational service. Some degradation in characteristics would be accepted at the higher entry rates, as long as it does not present a major threat to recovery from the point at which the pilot has recognized the stall. Guidance material is being proposed for AC 25-7 to point out that the specified deceleration rate, and associated rate of increase in angle of attack, should be established from the trim speed specified in § 25.103(b)(1) and maintained up to the point at which the airplane stalls.

The FAA proposes to revise § 25.203(c) to specify a bank angle that must not be exceeded during the recovery from the turning flight stall demonstrations. Currently, § 25.203(c) provides only a

qualitative statement that a prompt recovery must be easily attainable using normal piloting skill. By specifying a maximum bank angle limit, the FAA proposes to augment this qualitative requirement with a quantitative one.

For deceleration rates up to 1 knot per second, the maximum bank angle would be approximately 60 degrees in the original direction of the turn, or 30 degrees in the opposite direction. These bank angle limits are currently contained in JAR-25 guidance material, and have been used informally during FAA certification programs as well. For deceleration rates higher than 1 knot per second, the FAA proposes to allow a greater maximum bank angle - approximately 90 degrees in the original direction of the turn, or 60 degrees in the opposite direction. These are the same acceptance criteria currently used by the JAA to evaluate dynamic stall demonstrations.

In addition to the amendments to part 25 proposed in this notice, revisions to AC 25-7 are being proposed to ensure that the harmonized standards would be interpreted and applied consistently. AC 25-7 provides guidelines that the FAA has found acceptable regarding flight testing transport category airplanes to demonstrate compliance with the applicable airworthiness requirements. Public comments concerning the proposed revisions to AC 25-7 are invited by separate notice published elsewhere in this issue of the Federal Register.

Preliminary Regulatory Evaluation, Initial Regulatory Flexibility Determination, and Trade Impact Assessment

Three principal requirements pertain to the economic impacts of regulatory changes to the FARs. First, Executive Order 12291 directs

Federal agencies to promulgate new regulations or modify existing regulations only if the expected benefits to society outweigh the expected costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Finally, the Office of Management and Budget directs agencies to assess the effect of regulatory changes on international trade. In conducting these analyses, the FAA has determined that this rule: 1) would generate benefits exceeding costs and is neither major as defined in the Executive Order nor significant as defined in DOT's policies and procedures; 2) would not have a significant impact on a substantial numbers of small entities; and 3) would lessen restraints on international trade. These analyses, available in the docket, are summarized below.

Regulatory Evaluation Summary

Three of the proposed 48 revisions to the flight test airworthiness standards of part 25 would require additional flight testing and engineering analysis, resulting in compliance costs of $18,500 per type certification. When amortized over a representative production run of 500 airplanes, this total cost would result in a negligible incremental cost of $37 per airplane. The FAA solicits comments concerning the incremental flight test certification costs attributable to the proposed rule.

The primary benefits of the proposed rule would be harmonization of flight test airworthiness standards with the European Joint Aviation Requirements and clarification of existing standards. The resulting increased uniformity of flight test standards would simplify

airworthiness approval for import and export purposes and would avoid some of the costs that can result when manufacturers seek type certification under both sets of standards. While not readily quantifiable, the potential cost avoidance would exceed the relatively minor incremental costs of the proposed rule.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily or disproportionately burdened by Federal regulations. The RFA requires a Regulatory Flexibility Analysis if a proposed rule would have a significant economic impact, either detrimental or beneficial, on a substantial number of small entities. Based on FAA Order 2100.14A, Regulatory Flexibility Criteria and Guidance, the FAA has determined that the proposed amendments would not have a significant economic impact on a substantial number of small entities.

Trade Impact Assessment

The proposed rule would not constitute a barrier to international trade, including the export of American airplanes to foreign countries, and the import of foreign airplanes into the United States. Instead, the proposed flight testing standards have been harmonized with those of foreign aviation authorities, thereby lessening restraints on trade.

Federalism Implications

The amended regulations proposed in this rulemaking would not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore,

in accordance with Executive Order 12612, it is determined that this proposal would not have sufficient federalism implications to warrant preparing a Federalism Assessment.

Conclusion

Because the proposed changes to standardize specific flight requirements of part 25 of the FAR are not expected to result in substantial economic cost, the FAA has determined that this proposed regulation would not be major under Executive Order 12291. Because this is an issue which has not prompted a great deal of public concern, the FAA has determined that this action is not significant under DOT Regulatory Policies and Procedures (44 FR 11034, February 25, 1979). In addition since there are no small entities affected by this proposed rulemaking, the FAA certifies, under the criteria of the Regulatory Flexibility Act, that this rule, if adopted, will not have a significant economic impact, positive or negative, on a substantial number of small entities. An initial regulatory evaluation of the proposal, including a Regulatory Flexibility Determination and Trade Impact Analysis, has been placed in the docket. A copy may be obtained by contacting the person identified under **FOR FURTHER INFORMATION CONTACT.**

List of Subjects

14 CFR Part 1

Air transportation, Federal Aviation Administration

14 CFR Part 25

Aircraft, Aviation safety, Federal Aviation Administration, Reporting and recordkeeping requirements

The Proposed Amendments

Accordingly, the Federal Aviation Administration (FAA) proposes to amend 14 CFR Parts 1 and 25 of the Federal Aviation Regulations (FAR) as follows:

PART 1 - DEFINITIONS AND ABBREVIATIONS

1. The authority citation for part 1 continues to read as follows:

Authority: 49 U.S.C. app. 1347, 1348, 1354(a), 1357(d)(2), 1372, 1421 through 1430, 1432, 1442, 1443, 1472, 1510, 1522, 1652(e), 1655(c), 1657(f), and 49 U.S.C. 106(g).

2. Section 1.1 is amended by adding a new definition to read as follows:

§ 1.1 General definitions.

* * * * *

"Go-around power or thrust setting" means the maximum allowable in-flight power or thrust setting identified in the performance data.

* * * * *

PART 25 - AIRWORTHINESS STANDARDS - TRANSPORT CATEGORY AIRPLANES

3. The authority citation for part 25 continues to read as follows:

Authority: 49 U.S.C. app. 1344, 1354(a), 1355, 1421, 1423, 1424, 1425, 1428, 1429, 1430; 49 U.S.C. 106(g); and 49 CFR 1.47(a).

4. Section 25.119 is amended by revising paragraph (a) to read as follows:

§ 25.119 Landing climb: All-engines-operating.

* * * * *

(a) The engines at the power or thrust that is available eight seconds after initiation of movement of the power or thrust controls

from the minimum flight idle to the go-around power or thrust setting; and

* * * * *

5. Section 25.121 is amended by revising paragraph (d)(1) to read as follows:

§ 25.121 Climb: One-engine-inoperative.

* * * * *

(d) * * *

(1) The critical engine inoperative, the remaining engines at the go-around power or thrust setting;

* * * * *

6. Section 25.125 is amended by revising paragraph (a)(2) to read as follows:

§ 25.125 Landing.

* * * * *

(a) * * *

(2) A stabilized approach, with a calibrated airspeed of not less than 1.3 V_S or V_{MCL}, must be maintained down to the 50 foot height.

* * * * *

7. Section 25.143 is amended by revising paragraphs (c), (d), and (e) and adding a new paragraph (f) to read as follows:

§ 25.143 General.

* * * * *

(c) The following table prescribes, for conventional wheel type controls, the maximum control forces permitted during the testing required by paragraphs (a) and (b) of this section:

Force, in pounds, applied to the control wheel or rudder pedals	Pitch	Roll	Yaw
For transient application for pitch and roll control - two hands available for control	75	50	-
For transient application for pitch and roll control - one hand available for control	50	25	-
For transient application for yaw control	-	-	150
For sustained application	10	5	20

(d) Approved operating procedures or conventional operating practices must be followed when demonstrating compliance with the control force limitations for transient application that are prescribed in paragraph (c) of this section. The airplane must be in trim, or as near to being in trim as practical, in the immediately preceding steady flight condition. For the takeoff condition, the airplane must be trimmed according to the approved operating procedures.

(e) When demonstrating compliance with the control force limitations for sustained application that are prescribed in paragraph (c) of this section, the airplane must be in trim, or as near to being in trim as practical.

(f) When maneuvering at a constant airspeed or Mach number (up to V_{FC}/M_{FC}), the stick forces and the gradient of the stick force versus maneuvering load factor must lie within satisfactory limits. The stick

forces must not be so great as to make excessive demands on the pilot's strength when maneuvering the airplane, and must not be so low that the airplane can easily be overstressed inadvertently. Changes of gradient that occur with changes of load factor must not cause undue difficulty in maintaining control of the airplane, and local gradients must not be so low as to result in a danger of overcontrolling.

8. Section 25.145 is amended by revising paragraphs (b), (b)(3), (b)(4), and (c)(1) to read as follows:

§ 25.145 Longitudinal control

* * * * *

(b) With the landing gear extended, no change in trim control, or exertion of more than 50 pounds control force (representative of the maximum transient force that can be applied readily by one hand) may be required for the following maneuvers:

* * * * *

(3) Repeat paragraph (b)(2) except at the go-around power or thrust setting.

(4) With power off, flaps retracted, and the airplane trimmed at 1.4 V_{S1}, rapidly set go-around power or thrust while maintaining the same airspeed.

* * * * *

(c) * * *

(1) Simultaneous movement of the power or thrust controls to the go-around power or thrust setting;

* * * * *

9. Section 25.149 is amended by revising paragraphs (f), (g) and (h) to read as follows:

§ 25.149 Minimum Control Speed.

* * * * *

(f) V_{MCL}, the minimum control speed during approach and landing with all engines operating, is the calibrated airspeed at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with that engine still inoperative, and maintain straight flight with an angle of bank of not more than 5 degrees. V_{MCL} must be established with--

(1) The airplane in the most critical configuration (or, at the option of the applicant, each configuration) for approach and landing with all engines operating;

(2) The most unfavorable center of gravity;

(3) The airplane trimmed for approach with all engines operating;

(4) The most unfavorable weight, or, at the option of the applicant, as a function of weight;

(5) The propeller of the inoperative engine, if applicable, in the position it automatically achieves; and

(6) Go-around power or thrust setting on the operating engine(s).

(g) For airplanes with three or more engines, V_{MCL-2}, the minimum control speed during approach and landing with one critical engine inoperative, is the calibrated airspeed at which, when a second critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with both engines still inoperative, and maintain

straight flight with an angle of bank of not more than 5 degrees. V_{MCL-2} must be established with--

(1) The airplane in the most critical configuration (or, at the option of the applicant, each configuration) for approach and landing with one critical engine inoperative;

(2) The most unfavorable center of gravity;

(3) The airplane trimmed for approach with one critical engine inoperative;

(4) The most unfavorable weight, or, at the option of the applicant, as a function of weight;

(5) If applicable, the propeller of the more critical engine in the position it automatically achieves and the propeller of the other inoperative engine feathered;

(6) The power or thrust on the operating engine(s) necessary to maintain an approach path angle of 3 degrees when one critical engine is inoperative; and

(7) The power or thrust on the operating engine(s) rapidly changed, immediately after the second critical engine is made inoperative, from the power or thrust prescribed in paragraph (g)(6) of this section to-

(i) Minimum power or thrust; and

(ii) Go-around power or thrust setting.

(h) In demonstrations of V_{MCL} and V_{MCL-2}--

(1) The rudder force may not exceed 150 pounds;

(2) The airplane may not exhibit hazardous flight characteristics or require exceptional piloting skill, alertness, or strength;

(3) Lateral control must be sufficient to roll the airplane, from an initial condition of steady straight flight, through an angle of 20 degrees in the direction necessary to initiate a turn away from the inoperative engine(s), in not more than 5 seconds; and

(4) For propeller airplanes, hazardous flight characteristics must not be exhibited due to any propeller position achieved when the engine fails or during any likely subsequent movements of the engine or propeller controls.

10. Section 25.201 is amended by revising paragraphs (b), (c), and (d), redesignating paragraph (c)(2) as (c)(3), and adding new paragraphs (b)(4) and (c)(2) to read as follows:

§ 25.201 Stall demonstration.

* * * * *

(b) In each condition required by paragraph (a) of this section, it must be possible to meet the applicable requirements of § 25.203 with--

(1) Flaps, landing gear, and deceleration devices in any likely combination of positions approved for operation;

(2) Representative weights within the range for which certification is requested;

(3) The most adverse center of gravity for recovery; and

(4) The airplane trimmed for straight flight at the speed prescribed in § 25.103(b)(1).

(c) The following procedures must be used to show compliance with § 25.203:

(1) Starting at a speed sufficiently above the stalling speed to ensure that a steady rate of speed reduction can be established, apply

the longitudinal control so that the speed reduction does not exceed one knot per second until the airplane is stalled.

(2) In addition, for turning flight stalls, apply the longitudinal control to achieve airspeed deceleration rates up to 3 knots per second.

(3) As soon as the airplane is stalled, recover by normal recovery techniques.

(d) The airplane is considered stalled when the behavior of the airplane gives the pilot a clear and distinctive indication of an acceptable nature that the airplane is stalled. Acceptable indications of a stall, occurring either individually or in combination, are--

(1) A nose-down pitch that cannot be readily arrested, which may be accompanied by a rolling motion that is not immediately controllable (provided that the rolling motion complies with § 25.203(b) or (c) as appropriate);

(2) Buffeting, of a magnitude and severity that is a strong and effective deterrent to further speed reduction; or

(3) The pitch control reaches the aft stop and no further increase in pitch attitude occurs when the control is held full aft for a short time before recovery is initiated.

11. Section 25.203 is amended by revising paragraph (c) and adding new paragraphs (c)(1) and (c)(2) to read as follows:

§ 25.203 Stall characteristics.

* * * * *

(c) For turning flight stalls, the action of the airplane after the stall may not be so violent or extreme as to make it difficult, with normal piloting skill, to effect a prompt recovery and to regain control

of the airplane. The maximum bank angle that occurs during the recovery may not exceed--

(1) Approximately 60 degrees in the original direction of the turn, or 30 degrees in the opposite direction, for deceleration rates up to 1 knot per second; and

(2) Approximately 90 degrees in the original direction of the turn, or 60 degrees in the opposite direction, for deceleration rates in excess of 1 knot per second.

12. Section 25.253 is amended by revising paragraph (b) to read as follows:

§ 25.253 High-speed characteristics.

* * * * *

(b) *Maximum speed for stability characteristics,* V_{FC}/M_{FC}. V_{FC}/M_{FC} is the maximum speed at which the requirements of §§ 25.143(f), 25.147(e), 25.175(b)(1), 25.177, and 25.181 must be met with flaps and landing gear retracted. It may not be less than a speed midway between V_{MO}/M_{MO} and V_{DF}/M_{DF}, except that, for altitudes where Mach number is the limiting factor, M_{FC} need not exceed the Mach number at which effective speed warning occurs.

Issued in Washington, D.C. on

8/27/93

Proposed Revisions to Advisory Circular 25-7
Flight Test Guide for Certification of Transport Category Airplanes

Add the following sections to paragraph 20.a.:

(1) The maximum forces given in the table in § 25.143(c) for pitch and roll control for transient application are applicable to maneuvers in which the control force is only needed for a short period. Where the maneuver is such that the pilot will need to use one hand to operate other controls (such as the landing flare, or changes of configuration or power resulting in a change of control force that must be trimmed out) the single-handed maximum control forces will be applicable. In other cases (such as takeoff rotation, or maneuvering during en route flight), the two-handed maximum forces will apply.

(2) Transient and sustained forces should be interpreted as follows:

(i) Transient forces are those control forces that result from maintaining the intended flight path during configuration changes and normal transitions from one flight condition to another, or from regaining control following a failure. It is assumed that the pilot will take immediate action to reduce or eliminate such forces by re-trimming or changing configuration or flight conditions, and consequently transient forces are not considered to exist for any significant duration.

(ii) Sustained forces are those control forces that result from normal or failure conditions and that cannot readily be trimmed out or eliminated.

Add the following sections to paragraph 20.:

d. Acceptable Means of Compliance. An acceptable means of compliance with the requirement that stick forces may not be excessive when maneuvering the airplane is to demonstrate that, in a turn for 0.5g incremental normal acceleration (0.3g above 20,000 feet) at speeds up to V_{FC}/M_{FC}, the average stick force gradient does not exceed 120 lbs/g.

e. Interpretive Material.

(1) If flight testing indicates that the limit load factor would be exceeded in maneuvering flight with a 50 pound stick force, the airplane structure shall be evaluated and found satisfactory for the anticipated load at a 50 pound stick force. The airplane will be considered to have been overstressed if limit strength has been exceeded in any critical component.

(2) Minimum Stick Force to Reach Limit Strength.

(i) A stick force of 50 pounds to reach limit strength in steady maneuver or wind-up turns is considered acceptable to demonstrate adequate minimum force at limit strength in the absence of deterrent buffeting. If heavy buffeting occurs before the limit strength condition is reached, a somewhat lower stick force at limit strength may be acceptable. The acceptability of a stick force of less than 50 pounds at the limit strength condition will depend upon the intensity of the buffet, the adequacy of the warning margin (i.e., the load factor increment between the heavy buffet and the limit strength condition), and the stick force characteristics.

(ii) This minimum stick force applies in the en route configuration with the airplane trimmed for straight flight, at all speeds above the minimum speed at which the limit strength condition can be achieved without stalling. No minimum stick force is specified for other configurations, but the requirements of § 25.143(f) are applicable in these conditions.

(3) Stick Force Characteristics.

(i) At all points within the buffet onset boundary determined in accordance with § 25.251(e), but not including speeds above V_{FC}/M_{FC}, the stick force should increase progressively with increasing load factor. Any reduction in stick force gradient with change of load factor should not be so large or abrupt as to impair significantly the ability of the pilot to maintain control over the load factor and pitch attitude of the airplane.

(ii) Beyond the buffet onset boundary, hazardous stick force characteristics should not be encountered within the permitted maneuvering envelope as limited by paragraph 20.e.(3)(iii). It should be possible, by use of the primary longitudinal control alone, to pitch the airplane rapidly nose down so as to regain the initial trimmed conditions. The stick force characteristics demonstrated should comply with the following:

(A) For normal acceleration increments of up to 0.3g beyond buffet onset, where these can be achieved, local reversal of the stick force gradient may be acceptable, provided that any tendency to pitch up is mild and easily controllable.

(B) For normal acceleration increments of more than 0.3g beyond buffet onset, where these can be achieved, more marked reversals of the stick force gradient may be acceptable. It should be possible for any tendency to pitch up to be contained within the allowable maneuvering limits without applying push forces to the control column and without making a large and rapid forward movement of the control column.

(iii) In flight tests to satisfy paragraphs 20.e.(3)(i) and (ii), the load factor should be increased until either:

(A) The level of buffet becomes sufficient to provide a strong and effective deterrent to further increase of load factor; or

(B) Further increase of load factor requires a stick force in excess of 150 pounds (or in excess of 100 pounds when beyond the buffet onset boundary) or is impossible because of the limitations of the control system; or

(C) The positive limit maneuvering load factor established in compliance with § 25.337(b) is achieved.

(4) Negative Load Factors. It is not intended that a detailed flight test assessment of the maneuvering characteristics under negative load factors should necessarily be made throughout the specified range of conditions. An assessment of the characteristics in the normal flight envelope involving normal accelerations from 1g to zero g will normally be sufficient. Stick forces should also be assessed during other required flight testing involving negative load factors. Where these assessments reveal stick force gradients that are unusually low, or that are subject to significant variation, a more detailed assessment, in the most critical of the specified conditions, will be required. This may be based on calculations provided these are supported by adequate flight test or wind tunnel data.

Replace paragraph 21.a.(3) with the following:

(3) Section 25.145(c) contains requirements associated primarily with attempting a go-around maneuver from the landing configuration. Retraction of the high-lift devices from the landing configuration should not result in a loss of altitude if the power or thrust controls are moved to the go-around setting at the same time that flap/slat retraction is begun. The design features involved with this requirement are the rate of flap/slat retraction, the presence of any flap gates, and the go-around power or thrust setting.

(i) Flap gates, which prevent the pilot from moving the flap selector through the gated position without a separate and distinct movement of the selector, allow compliance with these requirements to be demonstrated in segments. High lift device retraction must be demonstrated beginning from the maximum landing position to the first gated position, between gated positions, and from the last gated position to the fully retracted position.

(ii) The go-around power or thrust setting should be the same as is used to comply with the approach and landing climb performance requirements of §§ 25.121(d) and 25.119, and the controllability requirements of §§ 25.145(b)(3), 25.145(b)(4), 25.145(b)(5), 25.149(f), and 25.149(g). The controllability requirements may limit the go-around power or thrust setting.

Replace paragraph 21.c.(6)(ii) with the following:

(ii) Test procedure: With the airplane stable in level flight at a speed of 1.1 V_s for propeller driven airplanes, or 1.2 V_s for turbojet powered airplanes, retract the flaps to the full up position, or the next gated position, while simultaneously setting go-around power. Use the same

power or thrust as is used to comply with the performance requirement of § 25.121(d), as limited by the applicable controllability requirements. It must be possible, without requiring exceptional piloting skill, to prevent losing altitude during the maneuver. Trimming is permissible at any time during the maneuver. If gates are provided, conduct this test beginning from the maximum landing flap position to the first gate, from gate to gate, and from the last gate to the fully retracted position. (The gate design requirements are specified within the rule.) Keep the landing gear extended throughout the test.

Revise the first sentence of paragraph 23.a. by replacing "landing approach (V_{MCL})" by "approach and landing V_{MCL} and V_{MCL-2})." Revise the second sentence in the same paragraph by replacing "V_{MCL}" with "V_{MCL} and V_{MCL-2}."

Replace paragraph 23.b.(2)(iii) with the following:

(iii) During determination of V_{MCG}, engine failure recognition should be provided by:

(A) The pilot feeling a distinct change in the directional tracking characteristics of the airplane, or

(B) The pilot seeing a directional divergence of the airplane with respect to the view outside the airplane.

Replace paragraph 23.b.(3) with the following:

(3) Minimum Control Speed During Approach and Landing (V_{MCL}) - § 25.149(f).

(i) This section is intended to ensure that the airplane is safely controllable following an engine failure during an all-engines-operating approach and landing. From a controllability standpoint, the most critical case consists of an engine failing after the power or thrust has been increased to perform a go-around from an all-engines-operating approach. Section 25.149(f) requires the minimum control speed to be determined that allows a pilot of average skill and strength to retain control of the airplane after the critical engine becomes inoperative and to maintain straight flight with less than five degrees of bank angle. Section 25.149(h) requires that sufficient lateral control be available at V_{MCL} to roll the airplane through an angle of 20 degrees, in the direction necessary to initiate a turn away from the inoperative engine, in not more than five seconds when starting from a steady straight flight condition.

(ii) Conduct this test using the most critical of the all-engines-operating approach and landing configurations, or at the option of the applicant, each of the all-engines-operating approach and landing configurations. The procedures given in paragraph 23.b.(1)(ii) for V_{MCA} may be used to determine V_{MCL}, except that flap and trim settings should be appropriate to the approach and landing configurations, the power or thrust on the operating engine(s) should be set to the go-around power or thrust

setting, and compliance with all V_{MCL} requirements of §§ 25.149(f) and (h) must be demonstrated.

Add the following new sections to paragraph 23b(3):

(iii) For propeller driven airplanes, the propeller must be in the position it automatically assumes following engine failure.

(iv) At the option of the applicant, a one-engine-inoperative landing minimum control speed, $V_{MCL(1\ out)}$, may be determined in the conditions appropriate to an approach and landing with one engine having failed before the start of the approach. In this case, only those configurations recommended for use during an approach and landing with one engine inoperative need be considered. The propeller of the inoperative engine, if applicable, may be feathered throughout. The resulting value of $V_{MCL(1\ out)}$ may be used in determining the recommended procedures and speeds for a one-engine-inoperative approach and landing.

Replace and re-designate paragraphs 23.b.(4), 23.b.4(ii), and 23.b.4(ii)(A) with the following:

(4) Minimum Control Speed with One Engine Inoperative During Approach and Landing (V_{MCL}-2) - § 25.149(g).

(iii) Conduct this test using the most critical approved one-engine-inoperative approach or landing configuration (usually the minimum flap deflection), or at the option of the applicant, each of the approved one-engine-inoperative approach and landing configurations. The following demonstrations are required to determine V_{MCL-2}:

(A) With the power or thrust on the operating engines set to maintain a -3 degree glideslope with one critical engine inoperative, the second critical engine is made inoperative and the remaining operating engine(s) are advanced to the go-around power or thrust setting. The V_{MCL-2} speed is established by the procedures presented in paragraph 23.b.(1)(ii) for V_{MCA}, except that flap and trim settings should be appropriate to the approach and landing configurations, the power or thrust on the operating engine(s) should be set to the go-around power or thrust setting, and compliance with all V_{MCL-2} requirements of §§ 25.149(g) and (h) must be demonstrated.

Add the following new sections to paragraph 23.b.(4):

(ii) For propeller driven airplanes, the propeller of the engine inoperative at the beginning of the approach may be in the feathered position. The propeller of the more critical engine must be in the position it automatically assumes following engine failure.

(iii) (C) Starting from a steady straight flight condition, demonstrate that sufficient lateral control is available at V_{MCL-2} to roll the airplane through an angle of 20 degrees in the direction necessary to initiate a turn away from the inoperative engines in not more than five seconds.

(iv) At the option of the applicant, a two-engines-inoperative landing minimum control speed, $V_{MCL-2(2\ out)}$, may be determined in the conditions appropriate to an approach and landing with two engines having failed before the start of the approach. In this case, only those configurations recommended for use during an approach and landing with two engines inoperative need be considered. The propellers of the inoperative engines, if applicable, may be feathered throughout. The values of V_{MCL-2} or $V_{MCL-2(2\ out)}$ should be used as guidance in determining the recommended procedures and speeds for a two-engines-inoperative approach and landing.

Add the following new section to paragraph 23.b.:

(5) Autofeather Effects. Where an autofeather or other drag limiting system is installed and will be operative at approach power settings, its operation may be assumed in determining the propeller position achieved when the engine fails. Where automatic feathering is not available the effects of subsequent movements of the engine and propeller controls should be considered, including fully closing the power lever of the failed engine in conjunction with maintaining the go-around power setting on the operating engine(s).

Replace paragraph 29.b.(3)(i) with the following:

(i) The pitch control reaches the aft stop and is held full aft for two seconds, or until the pitch attitude stops increasing, whichever occurs later. In the case of turning flight stalls, recovery may be initiated once the pitch control reaches the aft stop when accompanied by a rolling motion that is not immediately controllable (provided the rolling motion complies with § 25.203(c)).

Remove paragraph 29.b.(3)(iii) (and redesignate paragraphs 29.b.(3)(iv) and (v) as 29.b.(3)(iii) and (iv), respectively:

~~(iii) A roll that cannot be readily arrested with normal use of lateral/directional control.~~

Replace paragraph 29.d.(3)(i) with the following:

(i) The airplane should be trimmed for hands-off flight at a speed 20 percent to 40 percent above the stall speed, with the appropriate power setting and configuration. Then, using only the primary longitudinal control, establish and maintain a deceleration (entry rate) consistent with that specified in §§ 25.201(c)(1) or 25.201(c)(2), as appropriate, until the airplane is stalled. Both power and pilot selectable trim should remain constant throughout the stall and recovery (angle of attack has decreased to the point of no stall warning).

Replace paragraph 29.d.(3)(iii) with the following:

(iii) In addition, for turning flight stalls, apply the longitudinal control to achieve airspeed deceleration rates up to 3 knots per second. The intent of evaluating higher deceleration rates is to demonstrate

safe characteristics at higher rates of increase of angle of attack than are obtained from the 1 knot per second stalls. The specified airspeed deceleration rate, and associated angle of attack rate, should be maintained up to the point at which the airplane stalls.

Replace paragraph 29.d.(3)(iv) with the following:

(iv) For those airplanes where stall is defined by full nose-up longitudinal control for both forward and aft c.g., the time at full aft stick during characteristics testing should be not less than that used for stall speed determination. For turning flight stalls, however, recovery may be initiated once the pitch control reaches the aft stop when accompanied by a rolling motion that is not immediately controllable (provided the rolling motion complies with § 25.203(c)).

Add the following new section to paragraph 29.d.(3):

(vi) In level wing stalls the bank angle may exceed 20 degrees occasionally, provided that lateral control is effective during recovery.

DRAFT WORKING MATERIAL
NOT FOR PUBLIC RELEASE

PRELIMINARY REGULATORY EVALUATION, INITIAL REGULATORY FLEXIBILITY DETERMINATION, AND TRADE IMPACT ASSESSMENT (REVISED)

PROPOSED RULE
AIRWORTHINESS STANDARDS: FLIGHT

14 CFR
PART 1
PART 25

OFFICE OF POLICY, PLANS, AND MANAGEMENT ANALYSIS
AIRCRAFT REGULATORY ANALYSIS BRANCH, APO-320
Jules A. Ganoza
August 1993

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EXECUTIVE SUMMARY

This regulatory evaluation examines the economic impacts of a proposed rule that would amend the flight airworthiness standards of part 25 of the Federal Aviation Regulations (FAR). The primary aim of the proposed amendments is to harmonize certain flight requirements with standards contained in the European Joint Aviation Requirements (JAR-25). In addition, the proposal would adopt into regulation certain manufacturer flight test procedures, clarify existing requirements, and introduce editorial changes to enhance interpretation and attain consistency between supporting sections.

Three of the proposed 48 revisions would collectively add a total of approximately $18,500 per certification. When amortized over a representative production run of 500 airplanes, these costs would result in an increase of $37 per airplane. The primary benefit of harmonization with the JAR-25 would be the cost avoidance realized by manufacturers from the elimination of costly duplication of certification activities. These benefits, although not directly quantifiable, would far exceed the cost of the proposed amendments.

The proposed amendments would not have a significant economic impact on a substantial number of small entities. Additionally, the proposed rule would not constitute a barrier to international trade but rather would lessen the restraints on international trade through harmonization.

I. INTRODUCTION

This regulatory evaluation examines the economic impacts of a proposed rule to amend part 25 of the Federal Aviation Regulations (FAR). The goal of the proposed rule is to harmonize certain flight test requirements for transport category airplanes with the standards of the European Joint Aviation Requirements (JAR) 25. The proposals result from joint efforts between the Federal Aviation Administration (FAA), the European Joint Aviation Authorities (JAA), and the Aviation Rulemaking Advisory Committee (ARAC) to standardize the requirements, concepts, and procedures for certification flight testing of airplanes certificated in the U.S. and JAA countries under the FAR and JAR. Forthcoming revisions to FAA Advisory Circular 25-7, "Flight Test Guide for Certification of Transport Category Airplanes" would ensure that harmonized standards are interpreted and applied consistently.

The proposal would harmonize four sections of part 25 and JAR-25 identified by the Aerospace Industries Association of America, Inc. (AIA), and the Association Europeenne des Constructeurs de Material Aerospatial (AECMA) as containing different standards resulting in additional costs to manufacturers. By providing nearly the same flight test requirements for both the FAR and JAR, the proposed rule would accelerate airworthiness approval by enabling manufacturers to obtain type certificates under common standards. During the past decade manufacturers have employed flight test concepts and procedures exceeding minimum FAR requirements. Accordingly, many of the proposed changes would codify these industry practices into the regulations. Codification of industry flight testing practices and harmonization of FAA and JAA requirements would simplify airworthiness approval for import and export.

Most of the proposed amendments would result in either no additional costs or potential cost relief for manufacturers electing certain options. Three proposals would result in minor costs stemming from the need to perform additional flight testing and analysis. These minor costs, however, would be substantially outweighed by the savings accruing to manufacturers from avoiding the burden of certifying airplanes to dual standards. The assumptions and factors used in calculating the cost of compliance with the proposed amendments are outlined in Appendix A of this report.

II. BACKGROUND

Part 25 of the FAR contains the airworthiness standards that manufacturers must meet before the issuance of a U.S. type certificate for a transport category airplane. The JAA developed JAR 25 as a common airworthiness standard for use by the 19 countries that make up the European aviation community. While JAR 25 and FAR Part 25 are similar, they are not identical. At times, the differences are substantial. The additional efforts necessitated by non-uniform standards cause manufactures to incur costs and delays without discernible safety improvements.

On May 22, 1990, the AIA and AECMA petitioned the FAA and JAA to harmonize certain requirements contained in FAR part 25 and JAR 25. In their petition, published in the July 17, 1990 edition of the Federal Register, AIA and AECMA requested FAA to amend FAR part 25 to standardize the requirements, concepts, and procedures for certification flight testing and to enhance reciprocity between FAA and JAA. On September 26, 1991, the ARAC established the Flight Test Working Group. The Flight Test Working Group was assigned the task of

developing either a draft notice of proposed rulemaking (NPRM) or a denial of the AIA/AECMA petition. Later, the Flight Test Working Group, now named the Flight Test Harmonization Working Group, was further tasked with developing a similar proposal to amend JAR 25, as necessary, to achieve harmonization.

The Flight Test Harmonization Working Group developed the rulemaking proposal in this notice, and FAA proposes to amend FAR part 25 accordingly. These revisions would: (1) introduce the term "go-around power or thrust setting" to clarify certain FAR part 25 flight requirements; (2) revise the maximum control forces permitted for demonstrating compliance with the controllability and maneuverability requirements; (3) provide requirements for stick force and stick force gradients in maneuvering flight; (4) clarify the requirements for minimum control speed during landing approach; (5) clarify the procedural and configuration requirements for demonstrating stalls and revise the list of acceptable flight characteristics used to define the occurrence of a stall; and (6) require that stall characteristics be demonstrated for turning flight stalls at deceleration rates of up to 3 knots per second.

III. DESCRIPTION AND EVALUATION OF THE PROPOSED RULE

The proposed rule would amend one section of Part 1 and nine sections of part 25. The major aim of the proposed rule is to harmonize certain FAA flight requirements with those of the JAA while maintaining an acceptable level of safety. In addition, the proposed rule would update flight test certification standards, clarify current requirements, introduce new definitions, correct editorial errors, and reorganize certain requirements to improve referencing.

The majority of the proposed changes would not impose additional costs. Several sections would require additional flight testing and engineering analysis to conform with FAA's certification pass/fail test criteria. Appendix A of this report outlines the factors and assumptions used to estimate the cost of additional flight testing and engineering analysis.

§ 1.1 General definitions Section 1.1 would be amended with a new definition as follows: "Go around power or thrust setting" means the maximum allowable inflight power or thrust setting identified in the performance data. The addition of this definition clarifies that the applicable controllability requirements should be based on the same power or thrust setting used to determine the approach and landing climb performance contained in the approved Airplane Flight Manual (AFM). The proposed amendment would not impose additional costs.

§ 25.119 Landing Climb: All-engines-operating This section prescribes the minimum required climb gradient in the landing configuration.

Analysis of paragraph 25.119(a)

The proposal would replace the term, "takeoff position" with "go-around power or thrust setting" in paragraph 25.119 (a). Certain part 25 flight requirements involving flight conditions, other than takeoff, specify using maximum available takeoff power or thrust as indicative of the appropriate maximum in-flight power or thrust. The proposed revision acknowledges that the power or thrust setting used to obtain the maximum in-flight power or thrust (commonly referred to as the go-around power or thrust setting) usually

differs from the setting used for takeoff. These variances stem from the airspeed difference between the takeoff and go-around flight conditions and certain powerplant limitations. In this context, the proposal refers to the term "go around" as a deliberate maneuver to abort a landing attempt prior to touchdown or thrust, retracting flaps, and climbing to a safe level-off altitude. The proposed revision clarifies the intent of this section and codifies into regulation terminology commonly used in the operational environment. This adoption of new terminology would not impose additional compliance costs.

§ 25.121 Climb: One-engine-inoperative This section prescribes the flight configurations and characteristics that applicants must demonstrate to meet the climb with one engine inoperative requirements of Part 25.

Analysis of subparagraph 25.121 (d)(1)

The proposal would substitute the term, "go-around power or thrust setting" for "available takeoff power or thrust." The proposal would not result in additional compliance costs. For the same reasons as cited above for proposed paragraph 25.119 (a), this proposed change would clarify the intent of this section and codify into regulation the terminology commonly used in the operational environment.

§ 25.125 Landing This section outlines the configurations and range of conditions that applicants must comply with to satisfy the horizontal landing distance requirements of part 25.

Analysis of subparagraph 25.125 (a)(2)

The proposed revision to subparagraph 25.125 (a)(2) would add the requirement that the approach speed used to determine landing distance be not less than V_{MCL}, the minimum control speed for approach and landing with all engines operating. The proposal would require applicants to compare V_{MCL} with 1.3 V_S, the landing approach speed, at all landing weights, to determine whether V_{MCL} is greater than 1.3 V_S. The FAA estimates that this task would require 24 hours of engineering analysis at a rate of $60 per hour, and a total cost of $1,440.

If the applicant's analytical comparison establishes that V_{MCL} is greater than 1.3 V_S, then V_{MCL} would be the landing approach speed. In this event, the distance needed to land would increase because approach speeds would be faster than required by the current standards. The resulting flight performance data would be published in the AFM to supply operators with the horizontal distance needed to land and come to a complete stop at each weight, altitude, and wind within the airplane's operational limits. Accordingly, the flight performance data published in the AFM could increase the landing distance required for a particular operation or reduce the allowable landing weight for a given runway length for airplanes certificated after this rule becomes effective. Because V_{MCL} will generally only limit the approach speed at very light weights, if at all, this proposal is not expected to affect airplanes operators. The FAA solicits information from interested parties about possible impacts and costs of this proposal.

§ 25.143 General The proposed change to paragraph 25.143 (c) and the addition of new paragraph 25.143 (f) would be to provide harmonization with the corresponding controllability and maneuverability forces and flight test procedures of JAR 25. The proposed amendments to paragraphs 25.143 (d) and 25.143 (e) would also clarify flight test controllability and maneuverability requirements and make editorial changes to correct grammatical errors and improve readability.

Analysis of paragraph 25.143 (c)

Proposed paragraph 25.143 (c) would revise the table prescribing the maximum control forces for controllability and maneuverability required by paragraphs 25.143 (a) and 25.143 (b). The proposed revisions to the table would: 1) distinguish between those maneuvers in which one or two of the pilot's hands is assumed to be available for control and operation of the aircraft, 2) adjust the permissible force to be applied when one or two hands are used, 3) specify that prescribed control forces apply only to conventional wheel type controls, and 4) replace the terms "temporary" and "prolonged" with "transient" and "sustained", respectively. Transient forces refer to those control forces resulting from maintaining the intended flight path during those conditions that can be readily eliminated or reduced by re-trimming or changing flight conditions. Sustained forces are defined as those control forces resulting from normal or failure conditions that cannot readily be trimmed out or eliminated.

The proposal would reduce the maximum permissible control forces to be applied during a maneuver when only one hand is assumed to be available. The proposed

lower control forces would be harmonized with the control force limits now prescribed by JAR 25.143 (a). The proposed revision would codify flight test procedures that recognize that control force limits may differ when using other than wheel type controls such as sidestick and other type of controls. Finally, the substitution of the terms "transient" and "sustained" in lieu of "temporary" and "prolonged" are included to enhance harmonization and promote understanding.

The proposed redefinitions of acceptable pilot forces clarify these requirements and improve interpretation. Manufacturers have estimated that the elimination of subjective and multiple pilot evaluations would reduce flight testing by one to two hours. Using the cost parameters presented in Appendix A of this report, the proposal could relieve manufacturers of costs ranging between $3,500 and $7,000 per type certification.

Analysis of paragraph 25.143 (d)

Proposed paragraph 25.143 (d) is rewritten to improve comprehension. The proposal would substitute the word "transient" for "temporary." The proposed revision is an editorial clarification of an existing requirement.

Analysis of paragraph 25.143 (e)

The proposal would editorially revise paragraph 25.143 (e) to clarify the requirements for control force limitations. The proposal substitutes the term "sustained" for "prolonged." The proposed change is an editorial clarification of an existing requirement.

Analysis of paragraph 25.143 (f)

The proposed amendment would introduce JAR 25.143 (f) requirements on control force characteristics during maneuvering flight into the FAR as a new paragraph 25.143 (f). Current JAR 25.143 (f) requirements apply to the speed $V_{MO}/_{MO}$ (maximum operating speed limit). Proposed FAR paragraph 25.143 (f) specifies that when maneuvering at a constant air speed or Mach number up to V_{FC}/M_{FC} (maximum speed for stability characteristics), the stick forces and the gradient of the stick force gradient versus maneuvering load factor must lie within satisfactory limits. The proposal would harmonize these requirements and adopt into rule a current industry practice. The proposal would not result in additional costs.

§ 25.145 Longitudinal control The proposal would make four changes to this section. The following revisions in terminology and editorial corrections would not impose additional costs on applicants.

Analysis of paragraph 25.145 (b)

The proposal would substitute the word "transient" with the word "temporary" in the phrase, "representative of the maximum temporary force." The proposed substitution is consistent with the proposed revisions to paragraphs 25.143 (d) and (e).

Analysis of subparagraph 25.145 (b)(3)

The proposal substitutes the term "takeoff power" with "go-round power or thrust setting." The term "go around power or thrust setting" more accurately describes that the power or thrust setting used to obtain the maximum in-

flight power or thrust usually differs from the setting used for takeoff. The proposed editorial substitution would make this subparagraph consistent with the proposed revisions to § 1.1 and §§ 25.119, 25.121 (d), 25.145 (b)(4), 25.145 (b)(5), 25.145 (c)(1), 25.149 (f)(6) and 25.149 (g)(7)(ii).

Analysis of subparagraph 25.145 (b)(4)

The proposed rule substitutes the phrase "apply takeoff power rapidly" with the phrase "rapidly set go-around power or thrust." The proposed editorial substitution would make this subparagraph consistent with the proposed revisions to § 1.1 and §§ 25.119, 25.121 (d), 25.145 (b)(3), 25.145 (b)(5), 25.145 (c)(1), 25.149 (f)(6) and 25.149 (g)(7)(ii).

Analysis of subparagraph 25.145 (c)(1)

This subparagraph would be editorially revised to clarify its intent. Additionally, the term "takeoff power" would be replaced by "go-around power or thrust setting" to adopt into regulation the terminology commonly used in the operational environment. The proposed change could make this consistent the proposed revisions to § 1.1, and §§ 25.119, 25.121 (d), 25.145 (b)(3), 25.145 (b)(4), 25.145 (b)(5), 25.149 (f)(6) and 25.149 (g)(7)(ii).

§ 25.149 Minimum Control Speed Current § 25.149 addresses the procedures applicants must use in establishing the minimum control speeds during landing approach. The FAA proposes to make 19 revisions to paragraphs (f) through (h) of this section to clarify and harmonize the criteria for establishing minimum control speeds, V_{MCL} and V_{MCL-2}, for use during approach and landing. The proposed amendments also include provisions for propeller airplanes when

establishing minimum control speed and add flight test requirements currently contained in JAR-25.149.

The existing rule requires applicants to establish a V_{MCL} value assuming that one critical engine fails during a go-around following an approach to landing with all engines operating. The existing rule also requires that applicants establish corresponding V_{MCL-2} values for failures of a second critical engine during an approach with one critical engine already inoperative. The existing rule requires applicants to consider the "approach" configuration in establishing V_{MCL} and V_{MCL-2}. The proposal would require that the "landing" configuration be considered as well. The proposed revisions would not require applicants to perform additional tests and analysis. Accordingly, no costs are attributed to the proposed changes. These proposals would merely harmonize the regulations, clarify existing requirements, and adopt into regulation existing industry practices. However, the proposed V_{MCL} and V_{MCL-2} standards could require applicants, electing certain options, to perform a small amount of additional flight testing and related engineering review and computer analysis. Past certification programs have analytically derived multiple configuration versions of V_{MCL-2} under various engine inoperative and weight conditions. The FAA believes that a significant amount of this data would apply in future certification programs.

Analysis of paragraph 25.149 (f)

The proposed editorial revision would replace the term "landing approach" with "landing and approach" to clarify that the minimum control speed applies to

both of these distinct but related phases of flight testing. No cost is attributed to this proposed amendment.

Analysis of subparagraph 25.149 (f)(1)

Current subparagraph 25.149 (f)(1) requires that minimum control speed be established with the airplane in the "most critical configuration" for approach with all engines operating. The proposal would allow applicants the option of establishing V_{MCL} in the "most critical configuration" or "each configuration" for approach and landing. If the applicant considers V_{MCL} from the most critical configuration to be too constraining when used to determine speeds, the proposed rule would allow the applicant the latitude of performing tests to establish V_{MCL} for other configurations. The FAA believes that applicants would exercise the option provided by the proposal only if they would derive some net benefit. No cost is attributed to this proposal because it permits the applicant to continue the current practice of testing only the most critical configuration.

The proposal further revises the word "approach" to read "approach and landing" to emphasize that the criteria for establishing minimum control speed is applicable to the two related but distinct phases of flight testing. The proposed amendment would harmonize this subparagraph and make it consistent with related revisions.

Analysis of subparagraph 25.149 (f)(4)

This subparagraph would be revised to state more clearly that V_{MCL} must be established with "the most unfavorable weight" rather than with "the maximum

sea level landing weight." The proposal acknowledges that the maximum sea level landing weight may not represent the most critical condition needed to determine the most unfavorable weight as a prerequisite for establishing minimum control speed. The proposed revision would allow applicants the option of establishing V_{MCL} "as a function of weight" instead of "any lesser weight." If the most critical weight constrains operations at other weights, the applicant may elect to determine V_{MCL} appropriate for each weight. The FAA believes that applicants would exercise the options provided by the proposal only if they would benefit. No cost is attributed to this proposal because it permits the applicant to continue the current practice of testing only the most unfavorable weight. The proposed change would harmonize this subparagraph and make it consistent with related revisions.

Analysis of subparagraph 25.149 (f)(5)

The proposal would redesignate current subparagraph (5) as new subparagraph (6). Proposed new subparagraph (5) adds a harmonizing provision prescribing the position of the propeller of the inoperative engine(s), if applicable, when establishing V_{MCL}. The proposal would codify the standing certification practice and FAA policy of leaving the propeller of the inoperative engine in the position it automatically achieves. There would be no additional cost associated with the proposed amendment.

Analysis of subparagraph 25.149 (f)(6)

The proposal would relocate the intent of current subparagraph 25.149 (f)(5) here. The proposal editorially revises this subparagraph by substituting the phrase "maximum available takeoff power" with "go-round power or thrust

setting." As discussed in the analysis of subparagraph 25.145 (b)(3) above, the phrase "go around power or thrust setting" more precisely defines that the power or thrust setting used to obtain maximum in-flight power or thrust usually differs from the setting used for takeoff. The proposed revision would make this subparagraph consistent with the proposed addition to § 1.1 and revisions to §§ 25.119, 25.121 (d), 25.145 (b)(3), 25.145 (b)(4), 25.145 (b)(5), 25.145 (c)(1), ~~25.149 (f)(6)~~ and 25.149 (g)(7)(ii).

Additionally, the proposed redesignation of the term "engine" to "engine(s)" would extend the applicability of this subparagraph to all operating engines. No additional costs are attributed to the proposed amendment. The proposal is a clarification and reflects existing industry practice and FAA certification policy.

Analysis of paragraph 25.149 (g)

The proposal editorially revises the word "approach" to read "approach and landing." The proposed revision would emphasize that the criteria for establishing minimum control speed for airplanes with three or more engines applies to these two related but distinct phases of flight testing. The proposal is a clarification and would not impose additional costs.

Analysis of subparagraph 25.149 (g)(1)

The current rule requires that the applicant establish V_{MCL-2}, the minimum control speed in the "most critical configuration" for "approach" with the critical engine inoperative. The proposed amendment would add the

requirement that V_{MCL-2} also be established for the "landing" phase of flight. The proposal would also provide the applicant the option of establishing V_{MCL-2} at each configuration. The revision recognizes that there may be more than one critical configuration and that the applicant may elect to extend testing to all configurations. If the applicant considers V_{MCL-2} from the most critical configuration to be too constraining when used to determine speeds, the proposed rule would allow the applicant the latitude of performing tests to establish V_{MCL-2} for other configurations. The FAA believes that applicants would exercise the option provided by the proposal only if they would derive some net benefit. No cost is attributed to this proposal because it permits the applicant to continue the current practice of testing only the most critical configuration.

The proposal further revises the word "approach" to read "approach and landing" to emphasize that the criteria for establishing minimum control speed is applicable to the two related but distinct phases of flight testing. The proposed editorial revision is a clarification and would make this section consistent with related revisions.

Analysis of subparagraph 25.149 (g)(3)

The proposal makes one minor editorial change to this subparagraph. The word "the" is replaced with the word "one" to affirm that airplanes with three or more engines may have more than one critical engine. The proposal would adopt into rule the current certification practice of considering more than one engine as critical when establishing minimum control speed during landing.

Analysis of subparagraph 25.149 (g)(4)

The proposal would amend this subparagraph to more clearly describe that V_{MCL-2} must be established with "the most unfavorable weight" rather than with "the maximum sea level landing weight." This acknowledges that the prescribed maximum sea level landing weight may not represent the condition needed to determine the most unfavorable weight for establishing minimum control speed. The proposed revision would also allow applicants the option of establishing V_{MCL-2} "as a function of weight" instead of "any lesser weight." If the most critical weight constrains operations at other weights, the applicant may elect to determine the V_{MCL-2} appropriate for each weight. The FAA believes that applicants would exercise the options provided by the proposal only if they would derive some net benefit. No cost is attributed to this proposal because it permits the applicant to continue the current practice of testing only the most unfavorable weight. The proposed amendment would harmonize this subparagraph and make it consistent with related revisions.

Analysis of subparagraph 25.149 (g)(5)

The proposal redesignates current subparagraph (5) as new subparagraph (6). Proposed new subparagraph (5) adds a harmonizing provision prescribing, if applicable, that the propeller of the engine that fails be in the position it automatically achieves when establishing V_{MCL-2}. The proposal permits credit for automatic feathering systems but recognizes that automatic feathering mechanisms do not always work. Accordingly, the proposal would require applicants to show that automatic feathering systems are sufficiently reliable. The proposed amendments would not result in additional costs. The

proposed revision would codify the present certification practice of demonstrating the reliability of automatic feathering systems.

Analysis of subparagraph 25.149 (g)(6)

The proposal renumbers current subparagraph (6) as paragraph (7). The word "engines" would be modified to read "engine(s)." The proposed revision explains that under certain conditions only one engine may be operational. The proposal clarifies that minimum control speed for approach and landing is to be maintained in situations where a second critical engine suddenly fails and only one or two engines remain operational.

Analysis of subparagraph 25.149 (g)(7)

The proposed rule would editorially revise the word "engines" to read "engine(s)." The proposed revision recognizes that under certain conditions only one engine may be operational. The proposal is a clarification and would codify the current certification practice of changing the power or thrust used when an engine is inoperative to a different power or thrust setting when a second engine suddenly becomes inoperative.

Analysis of subparagraph 25.149 (g)(7)(i)

The proposal deletes the unnecessary word "available" from this subparagraph.

Analysis of subparagraph 25.149 (g)(7)(ii)

The proposed rule substitutes the phrase "maximum available takeoff power or thrust" with "go-around power or thrust setting." The proposal would clarify that the term "go around power or thrust setting" more accurately describes

that the power or thrust setting used to obtain the maximum in-flight power or thrust usually differs from the setting used for takeoff. The proposed editorial change would make this subparagraph consistent with the proposed revisions to § 1.1 and §§ 25.119, 25.121 (d), 25.145 (b)(3), 25.145 (b)(4), 25.145 (b)(5), 25.145 (c)(1), 25.149 (f)(6).

Analysis of paragraph 25.149 (h)

This paragraph establishes the rudder control forces required to maintain control at V_{MCL} and V_{MCL-2}. The proposal would reorganize the paragraph to clarify and simplify its requirements. The proposal would delete the nonessential statement "nor may it be necessary to reduce the power or thrust of the operating engines," because the requirements concerning thrust levels are adequately addressed in proposed paragraphs 25.149 (f)(6), 25.149 (g)(6), and 25.149 (g)(7).

Analysis of subparagraph 25.149 (h)(1)

The proposal editorially revises paragraph 25.149 (h) by moving the requirement that rudder control forces may not exceed 150 pounds to proposed subparagraph 25.149 (h)(1).

Analysis of subparagraph 25.149 (h)(2)

The proposal designates the second sentence in paragraph 25.149 (h) as proposed new subparagraph 25.149 (h)(2). The sentence "the airplane may not assume any dangerous attitude" is replaced by "the airplane may not exhibit any hazardous flight characteristics." The proposed revision improves readability and clarifies the intent of the rule.

Analysis of subparagraph 25.149 (h)(3)

The proposal would add a requirement that airplanes have enough lateral roll capability at the minimum control speed to roll through an angle of 20 degrees in not more than 5 seconds to start a turn away from the inoperative engine. The proposed revision would harmonize this subparagraph with the corresponding requirements of JAR 25.149. The FAA estimates that this requirement would add 15 minutes flight testing, a cost of approximately $875. Analysis of the resulting flight data would be performed by an aerospace engineer in 16 hours at a burdened rate of $60 per hour, a cost of $960. The proposed amendment would therefore add an incremental cost of $1,835 per type certification.

Analysis of subparagraph 25.149 (h)(4)

New subparagraph (h)(4) would add a provision for propeller airplanes requiring that hazardous flight characteristics must not be exhibited due to any propeller position achieved when the engine fails or during any likely subsequent movement of the engine or propeller controls. There are no costs attributed to this proposal. The proposal would adopt into regulation existing certification flight test practice and policy.

§ 25.201 Stall demonstration This section describes the airplane configurations and procedures that applicants must use to demonstrate stall speeds and stall handling characteristics. The proposal would make 12 changes to this section. The proposed changes revise the list of acceptable flight characteristics used to define the occurrence of a stall and clarify and more accurately describe stall demonstration requirements.

Analysis of paragraph 25.201 (b)

The proposal substitutes the word "either" with "each" to clarify that the intent of this paragraph is to cover normal rather than failure conditions by requiring that stalls need only be demonstrated for the approved configurations specified in § 25.203. The proposal coincides with current industry practice.

Analysis of subparagraph 25.201 (b)(1)

The proposal would require the inclusion of "deceleration devices" in stall characteristics demonstrations in any likely combination of positions approved for operation. Past certification programs have included all deceleration devices (e.g., speed brakes) in this phase of flight testing. The proposal codifies into rule an existing industry practice and would not impose additional costs.

Analysis of subparagraph 25.201 (b)(2)

The proposal would make a minor editorial change by deleting the word "and" from the end of this subparagraph.

Analysis of subparagraph 25.201 (b)(3)

The proposal would make a minor editorial change by adding the word "and" to the end of this subparagraph.

Analysis of subparagraph 25.201 (b)(4)

Proposed new subparagraph 25.201 (b)(4) would add that for stall demonstration the airplane be trimmed for straight flight at the speed prescribed in

subparagraph 25.103 (b)(1). The proposal moves the cross-reference to subparagraph 25.103 (b) here for editorial clarity and harmony with the JAR 25 format. No incremental costs are attributed to the proposed revision since it reflects current industry practice and current FAA certification policy.

Analysis of paragraph 25.201 (c)

The proposal would revise this paragraph by replacing the word "procedure" with "procedures." The proposed editorial revision would harmonize this paragraph and would not impose additional costs.

Analysis of subparagraph 25.201 (c)(1)

Subparagraph (c)(1) would be editorially revised to more accurately describe the procedures for demonstrating stall handling characteristics. The proposal moves the cross reference to paragraph 25.103 (b) to new subparagraph 25.201 (b)(4) for editorial clarity and harmony with the JAR 25 format.

Analysis of subparagraph 25.201 (c)(2)

The proposal would harmonize these requirements with the stall demonstration provisions to be specified in the corresponding section of the JAR. The proposal would redesignate this subparagraph in its entirety as new subparagraph 25.201 (c)(3). Proposed new subparagraph 25.201 (c)(2) would add the requirement that turning flight stalls must also be met at airspeed deceleration rates up to 3 knots per second. In practice, FAA certification testing and manufacturer's flight stall maneuvers have routinely been accomplished at deceleration entry rates of 1 to 2 knots per second. The specific addition of a more stringent flight stall maneuver would require

applicants to perform additional tests during the preparatory and demonstration phases of flight testing. This would involve one to two stall maneuvers for each of the 6 to 8 probable flap/slat settings likely to exist on future airplane designs. FAA estimates that performing these tests would require an additional 3 hours of flight testing at a cost of $3,500 per hour, totalling $10,500. Evaluation of the resulting flight test data would require an additional 80 hours of engineering analysis at $60 per hour, a total cost of $4,800. Accordingly, the combined cost of compliance with the new requirements of proposed subparagraph 25.201 (c)(2) is estimated to be $15,300 per type certification.

Analysis of subparagraph 25.201 (c)(3)

The proposal would redesignate current subparagraph 25.201 (c)(2) as new 25.201 (c)(3).

Analysis of paragraph 25.201 (d)

Paragraph 25.201 (d) lists the acceptable flight characteristics that must be used by applicants when demonstrating compliance with part 25 stall requirements. The proposal reassigns the requirements and definitions in subparagraph 25.201 (d)(1) to new proposed paragraph 25.201 (d). The proposal revises this paragraph to clarify and more precisely describe the flight characteristics used to define the occurrence of a stall. The proposed amendment aligns with current certification practice and would not impose additional costs.

Analysis of subparagraph 25.201 (d)(1)

Subparagraphs 25.201 (d)(1)(i) and 25.201 (d)(1)(ii) would be redesignated as proposed 25.201 (d)(1). The proposal removes subparagraph 25.201 (d)(2)(ii) as a stand alone item to clarify that a rolling motion, occurring by itself, is not considered an acceptable flight characteristic for defining the occurrence of a stall. In addition, proposed new 25.201 (d)(1) would specify that an acceptable indication of a stall, occurring either individually or in combination, is defined as "a nose-down pitch that cannot be readily arrested, which may be accompanied by a rolling motion that is not immediately controllable (provided that the rolling motion complies with subparagraph 25.203 (b) or (c), as appropriate)." No costs are attributed to this provision. The proposal would revise this subparagraph to conform with current certification practice.

Analysis of subparagraph 25.201 (d)(2)

Proposed subparagraph 25.201 (d)(2) would replace the criteria of subparagraphs 25.201 (d)(1)(iii) and 25.201 (d)(2) now used to describe the occurrence of a stall. The proposal deletes the current criteria and replaces it with "Buffeting, of a magnitude and severity that is a strong and effective deterrent to further speed reduction; or". No cost is attributed to this provision. The proposal is clarifying and conforms with industry flight test practice that only deterrent buffeting is considered to comply with the criteria defining the occurrence of a stall.

Analysis of subparagraph 25.201 (d)(3)

Proposed new 25.201 (d)(3) would be added to the list of acceptable flight characteristics that define a stall. New subparagraph 25.201 (d)(3) proposes that if the airplane does not continue to pitch up after the pitch control has been pulled back as far as it will go and held there for a short period of time, this condition be defined as a stall. The proposed addition conforms with current flight testing certification practice and would not cause applicants to incur additional costs.

§ 25.203 Stall Characteristics This section describes the procedural and configuration requirements for demonstrating stalls. Current paragraph 25.203 (c) prescribes that, for turning flight stalls, the action of the airplane after the stall may not be so violent or extreme as to make it difficult to effect a prompt recovery.. The stated procedure is subjective in nature and test results could vary significantly for different test pilots. The proposal would add two new paragraphs to require that bank angle not exceed a specified value during the recovery from the turning flight stall demonstrations. The proposal would harmonize these requirements with the existing criteria contained in JAR 25 guidance material. Forthcoming revisions to AC 25-7 will further ensure uniform interpretation for turning flight stall criteria.

Analysis of paragraph 25.203 (c)

The proposed rule makes one editorial revision to this paragraph. The proposal adds the phrase, "The maximum bank angle that occurs during the recovery may not exceed" at the end of this paragraph. The proposed revision

would be placed here to provide a logical connection for the addition of proposed new subparagraphs 25.203 (c)(1) and (2).

Analysis of subparagraph 25.203 (c)(1)

The proposed rule would add the harmonizing requirement that for turning flight stalls, the maximum angle that occurs during the recovery period may not exceed "approximately 60 degrees in the original direction of the turn, or 30 degrees in the opposite direction, for deceleration rates up to 1 knot per second; and..." The proposal would codify into regulation an FAA flight policy certification practice patterned after the criteria used by European manufacturers. Hence, the proposed revision would not cause applicants to incur additional costs.

Analysis of subparagraph 25.203 (c)(2)

The proposal would add the harmonizing requirement that for turning flight stalls, the maximum angle that occurs during the recovery period may not exceed "approximately 90 degrees in the original direction of the turn, or 60 degrees in the opposite direction, for deceleration rates in excess of 1 knot per second; and...." The proposed amendment would adopt into regulation a flight certification practice based on the criteria contained in JAR 25 guidance material. For the same reasons as cited in proposed subparagraph 25.203 (c)(1), the proposal would not cause applicants to incur additional costs.

§ 25.253 High-speed characteristics This section prescribes the operating procedures and configuration requirements that applicants must meet for speed increase and recovery characteristics.

Analysis of paragraph 25.253 (b)

Paragraph 25.143 (f) would be added to this section as a reference. The editorial revision would make this section consistent with the proposed revision to § 25.143, General.

IV. SUMMARY OF COSTS

Table 1 summarizes estimates of the costs that the proposed rule would impose on manufacturers of transport category airplanes. The combined cost of $18,500 per type certification is attributed to the additional flight testing and engineering analysis that would result from the proposed rule. When amortized over a representative production run of 500 airplanes[1], this total cost results in an incremental cost of $37 per airplane. In comparison with the total cost of developing and certifying a transport category airplane to Part 25 standards (varying between $300 and $500 million), the cost of the proposed rule would be negligible.

Many of the proposed changes reflect current flight testing and analytical practices. Some of the proposed revisions are clarifications aimed at improving understanding of complex flight testing requirements. There is uncertainty, however, about the potential impact on operators that may result

[1] Source: World Jet Airplane Inventory - Year-End 1992 - Boeing Commercial Airplane Group - Table 4 -Total World Jet Airplane Deliveries 1952-1992

from the V_{MCL} requirements of proposed subparagraph 25.125 (a)(2). Accordingly, the FAA solicits comments on these and other certification costs that might result from the proposed rule.

TABLE 1

SUMMARY OF COSTS PER TYPE CERTIFICATION

Section	Type of Cost	Cost
25.125 (a)(2)	Analysis	$1,440
25.149 (h)(3)	Flight Test /Analysis	$1,835
25.201 (c)(2)	Flight Test /Analysis	$15,300
Total Costs		$18,575

V. BENEFITS

The primary benefits of the proposed rule would be harmonization and clarification of flight test airworthiness requirements. The proposed revisions reflect the efforts of the FAA and the JAA to develop a common set of airworthiness standards. The resulting increased uniformity of flight test standards would simplify airworthiness approval for import and export purposes and would avoid some of the costs that can result when manufacturers seek type certification to both standards. As a result of harmonization, applicants would be relieved of the costly burden of demonstrating, through validation flight testing and/or analytical processes, that designs certificated to U.S. standards also meet the requirements of the JAA. These additional expenditures frequently do not have a corresponding safety value. The FAA is

unable to quantitatively estimate the savings that would accrue to manufacturers from avoiding the duplication of certification activities. Other unquantifiable benefits would also result from the efficiency and clarification aspects of the proposals. Many provisions would clarify existing requirements, thereby eliminating confusion about specific flight testing configurations and standards needed for product certification. The FAA believes that the benefits of the proposed rule would far outweigh its relatively modest costs.

VI. OUTLINE SUMMARY OF PROVISIONS

The table below summarizes the sections that would be revised by the proposed rule and the estimated cost and benefit of each.

Section	Cost Per Type Certification	Benefits
Section 1.1 General	None	Editorial Reference
Section 25.119 Landing: Climb-All engines operating		
Paragraph 25.119 (a)	None	Clarification
Section 25.121 Climb:One engine-inoperative		
Subparagraph 25.121 (d)(1)	None	Clarification
Section 25.125 Landing		
Subparagraph 25.125 (a)(2)	$1,440	Clarification
Section 25.143 General		
Paragraph 25.143 (c)	None	Potential Cost Relief ($3,500 - S7,000) /Harmonization
Paragraph 25.143 (d)	None	Clarification
Paragraph 25.143 (e)	None	Clarification
Subparagraph 25.143 (f)	None	Harmonization
Section 25.145 Longitudinal Control		
Paragraph 25.145 (b)	None	Clarification
Subparagraph 25.145 (b)(3)	None	Clarification

Section	Cost Per Type Certification	Benefits
Subparagraph 25.145 (b)(4)	None	Clarification
Subparagraph 25.145 (c)(1)	None	Clarification
Section 25.149 Minimum Control Speed		
Paragraph 25.149 (f)	None	Clarification
Subparagraph 25.149 (f)(1)	None	Harmonization
Subparagraph 25.149 (f)(4)	None	Harmonization
Subparagraph 25.149 (f)(5)	None	Harmonization
Subparagraph 25.149 (f)(6)	None	Clarification
Paragraph 25.149 (g)	None	Clarification
Subparagraph 25.149 (g)(1)	None	Harmonization
Subparagraph 25.149 (g)(3)	None	Codification
Subparagraph 25.149 (g)(4)	None	Harmonization
Subparagraph 25.149 (g)(5)	None	Harmonization
Subparagraph 25.149 (g)(6)	None	Clarification
Subparagraph 25.149 (g)(7)	None	Clarification
Subparagraph 25.149 (g)(7)(i)	None	Clarification
Subparagraph 25.149 (g)(7)(i)(ii)	None	Clarification
Paragraph 25.149 (h)	None	Clarification
Subparagraph 25.149 (h)(1)	None	Editorial
Subparagraph 25.149 (h)(2)	None	Clarification
Subparagraph 25.149 (h)(3)	$1,835	Harmonization
Subparagraph 25.149 (h)(4)	None	Codification

Section	Cost Per Type Certification	Benefits
Section 25.201 Stall Demonstration		
Paragraph 25.201 (b)	None	Clarification
Subparagraph 25.201 (b)(1)	None	Codification
Subparagraph 25.201 (b)(2)	None	Clarification
Subparagraph 25.201 (b)(3)	None	Clarification
Subparagraph 25.201 (b)(4)	None	Harmonization
Subparagraph 25.201 (c)(1)	None	Harmonization
Subparagraph 25.201 (c)(2)	$15,300	Harmonization
Subparagraph 25.201 (c)(3)	None	Clarification
Paragraph 25.201 (d)	None	Codification
Subparagraph 25.201 (d)(1)	None	Codification
Subparagraph 25.201 (d)(2)	None	Codification
Subparagraph 25.201 (d)(3)	None	Codification
Section 25.203 Stall Characteristics		
Paragraph 25.203 (c)	None	Clarification
Subparagraph 25.203 (c)(1)	None	Harmonization
Subparagraph 25.203 (c)(2)	None	Harmonization
Section 25.253 High Speed Characteristics		
Subparagraph 25.253 (b)	None	Clarification

VII. REGULATORY FLEXIBILITY DETERMINATION

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily or disproportionately burdened by Federal regulations. The RFA requires a Regulatory Flexibility Analysis if a proposed rule would have a significant economic impact, either detrimental or beneficial, on a substantial number of small entities. Based on FAA Order 2100.14A, Regulatory Flexibility Criteria and Guidance, the FAA has determined that the proposed amendments would not have a significant economic impact on a substantial number of small entities.

VIII. TRADE IMPACT ASSESSMENT

The proposed rule would not constitute a barrier to international trade, including the export of American airplanes to foreign countries and the import of foreign airplanes into the United States. Instead, the proposed flight testing standards have been harmonized with those of foreign aviation authorities, thereby lessening restraints on trade.

APPENDIX A

ESTIMATING METHODS AND FACTORS

The following factors are used to calculate the incremental costs of flight testing and engineering analysis requirements.

- Cost of certification flight testing for a Part 25 airplane -- $3,500 per hour.
- Aircraft operating costs are based on the variable operating costs of a 2-engine wide-body airplane, consisting of flight crew, fuel and oil, and maintenance .
- Cost of fuel and oil per hour -- $860.
- Cost of maintenance per hour -- $70.
- Flight hour to maintenance ratio for a test aircraft -- 12 to 1.
- Maintenance cost per flight hour -- $840 ($70 X 12).
- An 8-person flight test crew is assumed, comprised of 2 flight deck crewmembers, 2 flight test (aerospace) engineers, and 4 flight test equipment technicians.
- Burdened rate of flight deck crewmembers -- $150 per hour.
- Burdened rate of aerospace engineers -- $60 per hour.
- Burdened rate of flight test technicians -- $45 per hour.
- All hourly flight test crew costs are multiplied by a factor of 3 to account for the time dedicated to pre-flight, test flight, and post-flight activities.
- Cost of performing engineering and computer analysis -- $60 per hour
- All monetary values are expressed in 1993 dollars.